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Structure of the liquid-vapor interface of a dilute ternary alloy: Pb and In in Ga
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Beamline(s): X19C

Introduction: We report the results of experimental studies of how the competition between two solutes to segregate in the liquid-vapor interface of a dilute ternary alloy influences the composition and structure of that interface.

Methods and Materials: Two Ga alloy samples contained 0.039 atom % of Pb and 6.31 atom % of In, 0.039 atom% of Pb, and 12.2 atom % of In, respectively. X-ray Reflectivity was carried out at wavelength 0.0700 nm, and Grazing Incidence X-ray Diffraction was carried out at wavelength 0.0850nm.

Results: For a ternary PbInGa alloy that contains 0.039 atom % Pb and 6.31 atom % In, the Pb that segregates in the liquid-vapor interface forms a two-dimensional hexagonal crystal phase that undergoes a first order transition to a disordered phase at T = 29.0°C ±0.1°C. For a ternary PbInGa alloy that contains 0.039 atom % Pb and 12.2 atom% In, Pb that segregates in the liquid-vapor interface forms a two-dimensional liquid down to 26.0°C, the lowest temperature at which data were taken. The two-dimensional crystalline Pb, which forms about 0.6 of a full monolayer, and the two-dimensional liquid In fills the remainder of the monolayer without mixing. For temperatures in excess of 29.0°C two-dimensional liquid Pb and two-dimensional liquid In coexist in the interface, with the fractional occupation of the monolayer by In exceeding the fractional occupation by Pb.

References:
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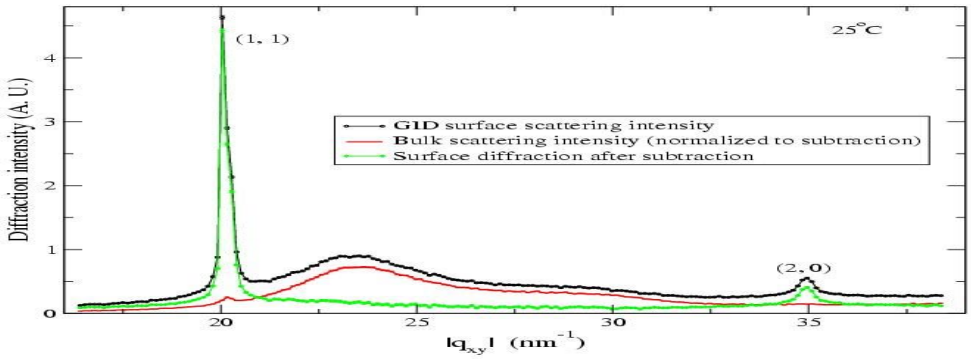

Fig. 1, a typical GID diffraction pattern

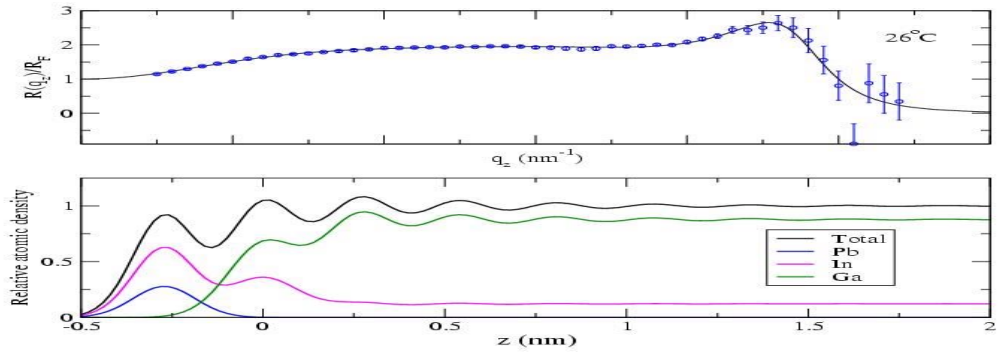

Fig. 2, a typical reflectivity pattern and model fit